Compact Multiband Microstrip patch Antenna for Wireless Application

Dungrani Akashkumar Ashokbhai[1], Shilpa Rana[2]

[1] *P.G. Student, Communication system Engineering Department, LDCE, Gujarat, India*
[2] *Assistant Professor, Communication system Engineering Department, LDCE, Gujarat, India*

ABSTRACT

In this article, the rectangular multiband Microstrip patch antenna is introduced. Here one cross slot and two rectangular slots in the patch is used to produce different resonant frequencies. The correct probe feed location is decided by parametric method give the promising results. The interesting features of proposed structure are that we get a multiband response in the frequency range 2.5 GHZ -2.65GHZ, 4.95GHZ - 5.25GHZ and 5.80GHZ - 6.0GHZ *which has applications for IEEE 802.11a and IEEE 802.11b WLAN.*
Keyword: *Multiband, Microstrip patch antenna*

1. INTRODUCTION

In the recent years, the development of communication systems requires low cost, minimal weight, low profile antennas that are capable of maintaining high performance over a wide spectrum of frequencies and we need an antenna which provides image, speech and data communications at any time, and anywhere around the world. So, we have to design a wideband antenna, which covers most of the wireless devices. But, there is a requirement of more power to design a wideband antenna. So, it's the major problem while designing this antenna. The solution to this problem is a multiband antenna which supports multiple band frequencies. Here power requirement is less compared to the wideband antenna. These antennas often use designs where one part of the antenna is active for one band, and another part is active in a different band and one more thing a multiband antenna may have a gain which is lower than the average.

2. ANTENNA DESIGN

A configuration of reference antenna is given in figure (1) and the result of the reference antenna is shown in figure (5).The dimension of the reference antenna is shown in table -1.Here the size of the ground plane is 50mm×50mm and the size of the radiating patch is 25mm×25mm.the antenna is mounted on FR4 substrate of dielectric constant 4.4 have a tangent loss ($\tan^{\delta}$) =0.02 and thickness is 1.6mm. The inner and outer diameter of the feeding probe is 1mm and 3mm respectively. The performance of reference antenna is optimizing using two more rectangular slots on patch and changes the position of the slot on patch and ground plane . The dimension is given in table 2. [3]

Table -1: Parameter of Reference Antenna (All the dimensions are in mm)

Lg	50	d1	1
Wg	50	d2	2.5
Lp	25	d3	3
Wp	25	g1	20
x	13.5	g2	3
y	6	xg	25

l1	2	yg	1
l2	8	Єr	4.4

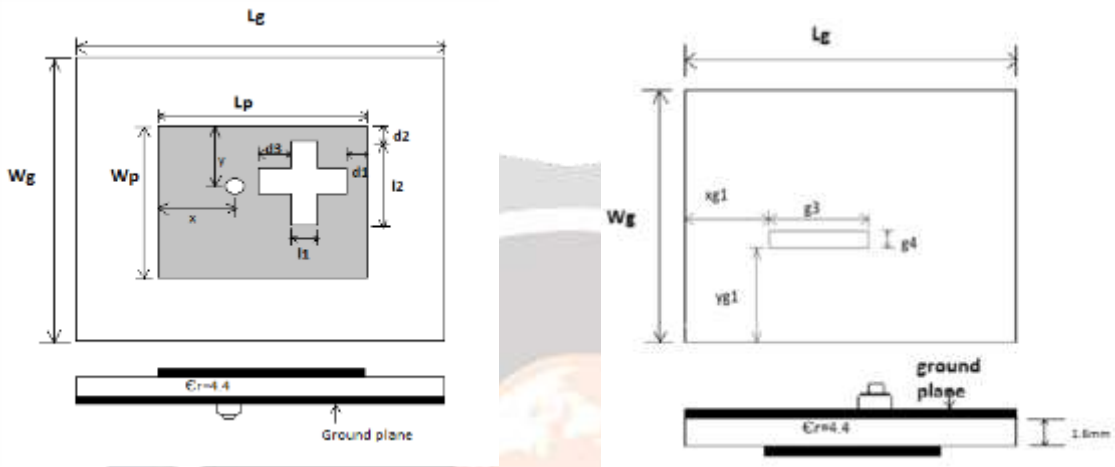

Figure 1: Top view and bottom view of reference Antenna [3]

In the table -2 dimensions of the proposed antenna are given and top view and bottom view of proposed antenna is shown in figure (2).The results of the proposed antenna are shown in figure (5) and figure (6).

Table -2: Parameter of proposed Antenna (All the dimensions are in mm)

Lg	52.4	d1	0.68
Wg	42.9	d2	3.02
Lp	25.36	d3	2.5
Wp	19.02	g3	20
X(feed)	0	g4	3
Y(feed)	24.65	xg1	11
l1	2	yg1	20
l2	8	Єr	4.4
xp1	12.68	yp1	0.51
xp2	10.68	yp2	3.51
xl1	2	yl1	8

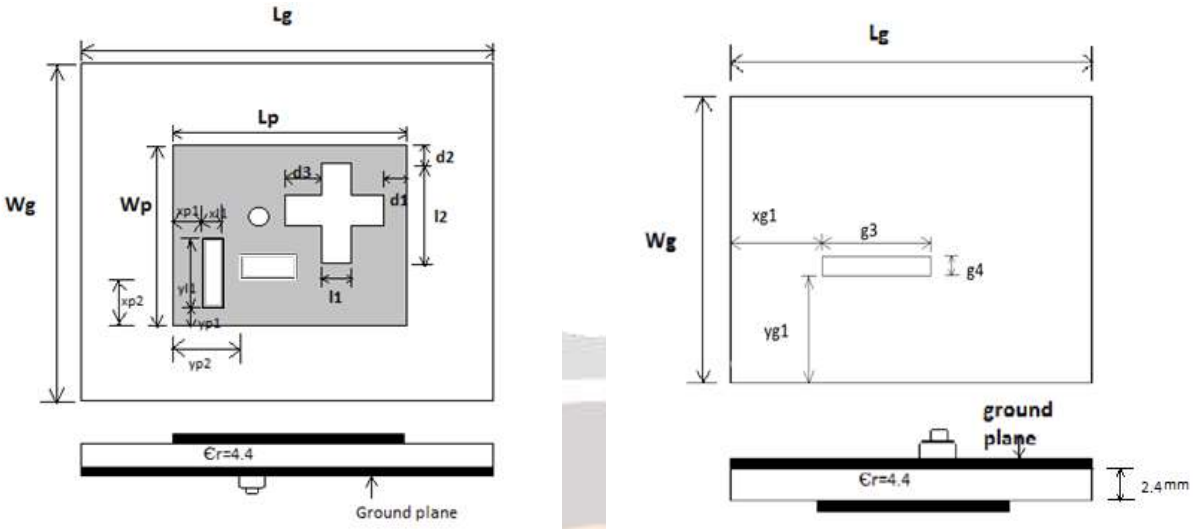

Figure 2: Top view and bottom view of proposed Antenna

3. RESULTS AND SIMULATION

The reference antenna is 25mm×25mm patch and a 50mm×50mm ground plane which is design to work as a reference antenna. The plot of reflection coefficient vs. frequency of reference antenna is shown in figure (3).

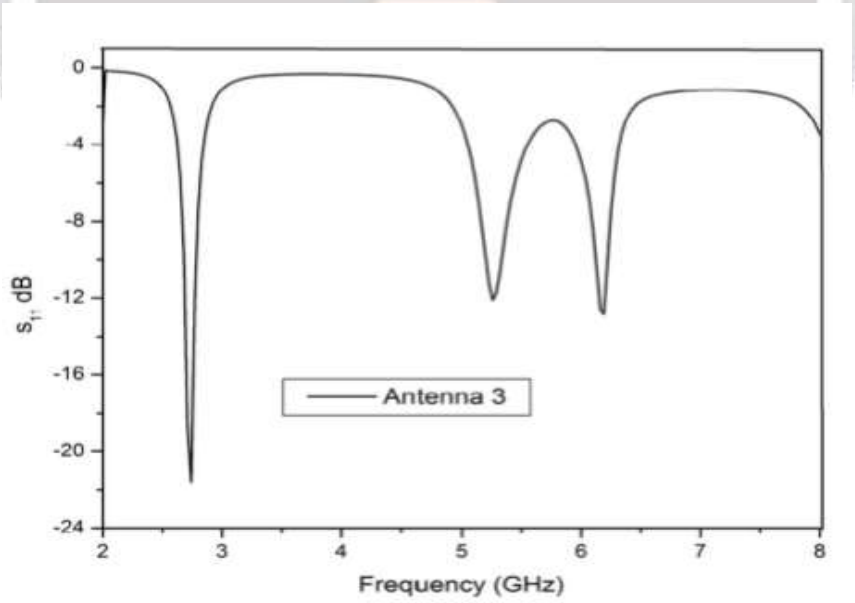

Figure -3: Plot of reflection coefficient vs frequency of reference Antenna [3]

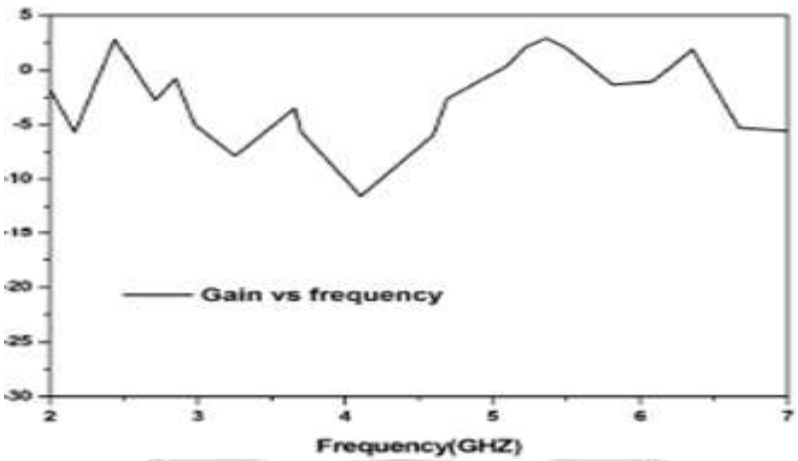

Figure -4: Gain vs frequency of reference antenna

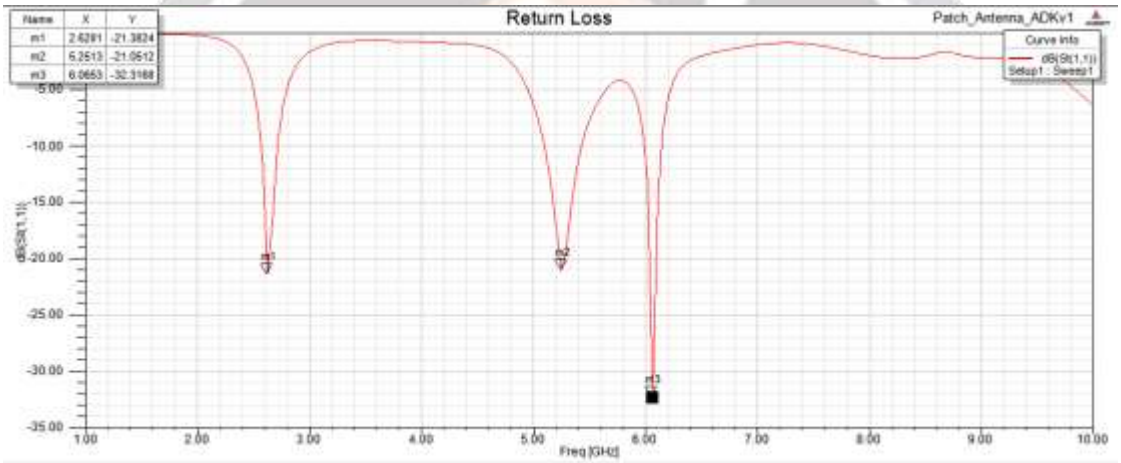

Figure -5: Plot of reflection coefficient vs frequency of proposed Antenna [3]

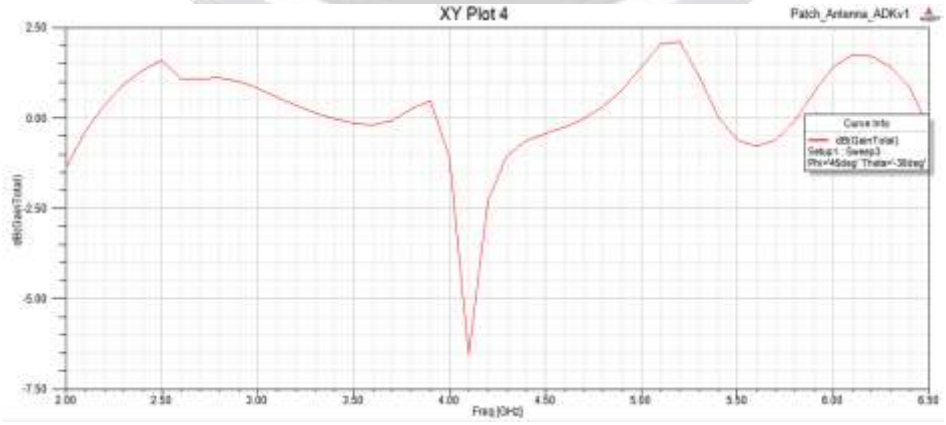

Figure -6: Gain vs frequency of proposed antenna

3.1 Slot in patch

After inserting a slot in patch it's create a slow wave effect and shifted in lower band frequency which is applicable for WLAN.

3.2 Rectangular slot in the ground plane

In this structure, the close-ended rectangular slot is inserted in the ground plane. The simulated reflection coefficient vs frequency plot is changed and we get a better-optimized result in proposed one. In proposed antenna -10dB impedance bandwidth are 2.5 GHZ -2.65GHZ, 4.95GHZ - 5.25GHZ and 5.80GHZ - 6.0GHZ, which is applicable for WLAN.

4. Fabrication and Testing

This chapter describes the fabrication and testing of CPW-fed 'U' shaped dual band
Microstrip patch antenna. The material used for fabrication of antenna is PEC (copper) of height 0.07 mm with FR4 substrate of dielectric constant 4.4 and thickness 2.4 mm. The top and bottom view of fabricated antenna with SMA port is shown in figure 7 and S11 as well as VSWR is given in figure 8, 9, 10 for different bands.

Figure-7: Top and bottom view of proposed antenna

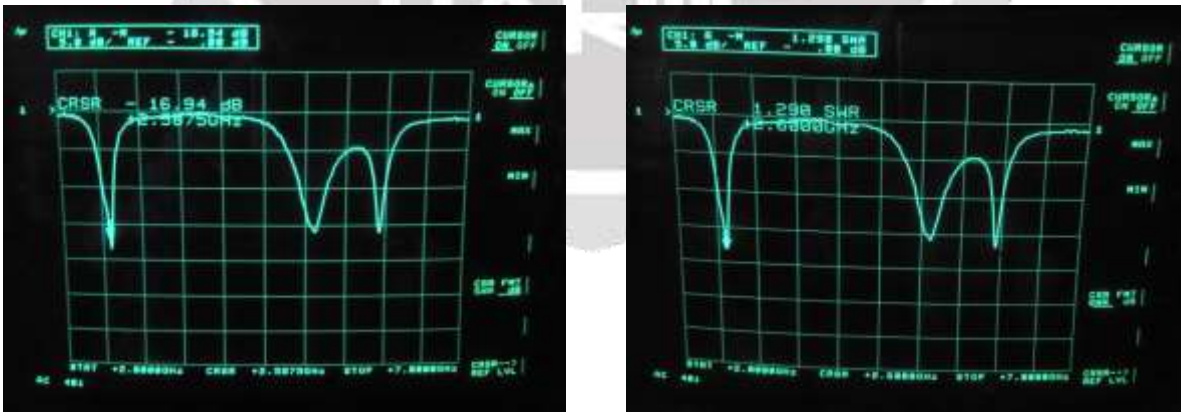

Figure -8: Plot of S11 vs frequency and VSWR vs frequency of proposed Antenna for 2.58 GHZ

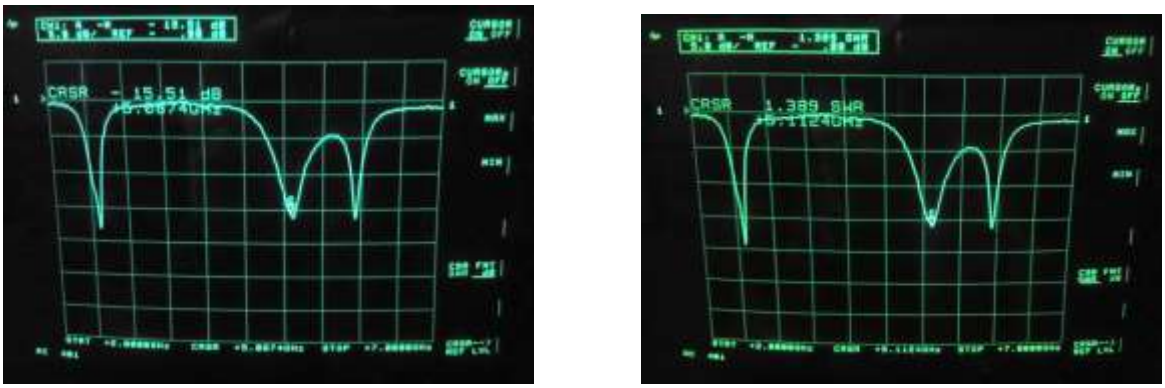

Figure -9: Plot of S11 vs frequency and VSWR vs frequency of proposed Antenna for 5.11GHZ

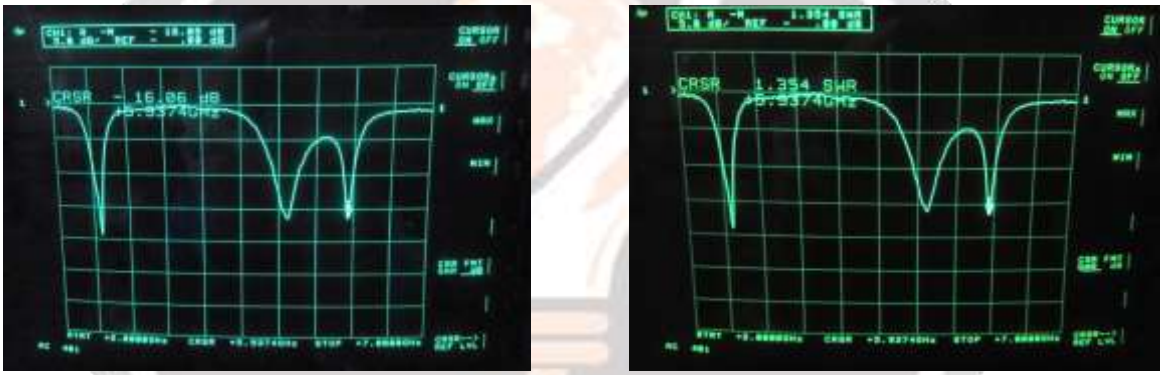

Figure -10: Plot of S11 vs frequency and VSWR vs frequency of proposed Antenna for 5.93 GHZ

5. CONCLUSIONS

The multiband, single feed, low profile and low-cost patch antenna are configured, simulated and measured. In this article close ended cross and rectangular slot are in the patch and one rectangular slot in the ground plane is inserted. The simulation results show multiband characteristics at frequency 2.5 GHZ -2.65GHZ, 4.95GHZ - 5.25GHZ and 5.80GHZ - 6.0GHZ.These bands can be used for various WLAN applications such as WiMax, HIPERLAN etc.

REFERENCES

[1] Constantine A. Balanis,"Antenna Theory-Analysis and Design", Second Edition, John Wiley and Sons, Inc.,1997.

[2] Ramesh Garg,"Microstrip Antenna design handbook", Artech house Antennas and propagation library, Inc.,2001.

[3] Bappadittya Roy, P. Das, Ankan Bhattacharya, A.K. Bhattacharjee, S.K. Chowdhury, "compact multiband rectangular antenna for wireless Application", IEEE, 2016.

[4] Ishita Sharma, Jatin Kumar, Jayatee Sarma, Prateek Kumar Singh, Ratnesh Dwivedi, Abhishek Kumar Jain," Multiband microstrip antenna with circular polarization for wireless communication", IEEE,2015.

[5] Bappadittya Roy, P. Das, Ankan Bhattacharya, A.K. Bhattacharjee, S.K. Chowdhury, "Effect of Different Slots in a Design of Microstrip Antennas", IEEE, 2015.

[6] A.Anandan 'Compact Multi-Band Microstrip Antenna for Wireless Application'GRD Journals -2016.

[7] Arshdeep Kaur Bhava, Sushil Kumar, 'Design and optimization of Multiband F-shaped fractal patch Antenna for wireless Application', IEEE 2015.